EARTH OBSERVING SYSTEM DATA
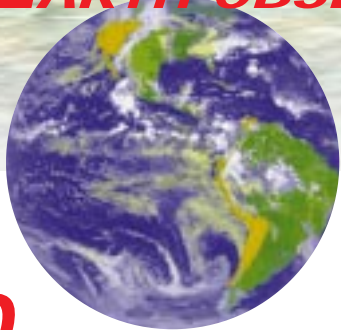
http://eos.nasa.gov/

EOSDIS

Observed on a global scale, the Earth is always changing. The changes around the globe can have huge effects on world economies and on the quality of life of ourselves and our children. Recently, humanity has developed the tools to observe, to measure, and to begin to understand our constantly changing planet.
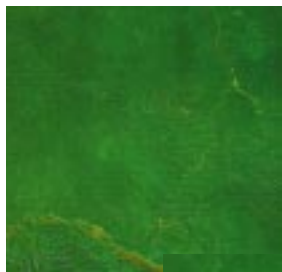
USGCRP

Global change research brings significant benefits to the nation and the world by providing a rigorous scientific understanding of the Earth system needed to facilitate intelligent decisions to ensure the availability of future resources essential for human well-being, including water, food, and ecosystems. The U.S. Global Change Research Program (USGCRP), focuses the activities of research institutions within the U.S., and coordinates with those beyond our borders, to observe, understand, and predict global change and its consequences. Continuing to improve scientific understanding of the Earth system is a priority of the National Science and Technology Council's Committee on Environment and Natural Resources.

ESE

NASA's Earth Science Enterprise (ESE) captures the spirit of exploration and focuses it back on the Earth. NASA and its interagency and international partners are striving to discover patterns in climate that will allow us to predict and respond to environmental events—such as floods and severe winters—well in advance of their occurrence. Nations, regions, and individuals can use this knowledge to prepare for these events, likely saving countless lives and resources.

Landsat Pathfinder Multispectral Scanner (MSS) images of the state of Rondonia, Brazil for June 19, 1975 (top) and August 1, 1986 (bottom). Systematic cutting of the forest vegetation starts along roads and then fans out to create the "feather" or "fishbone" pattern shown in the 1986 image. The deforested land and urban areas appear in light yellow; healthy vegetation appears in green (EROS Data Center).

Front cover image: Earth Observing System (EOS) AM-1 Spacecraft (NASA/Goddard Space Flight Center).

EOS

The Earth Observing System (EOS) is the principal component of NASA's Earth Science Enterprise. EOS involves a series of satellites that orbit the Earth, carrying advanced instruments that have a broad range of spatial and spectral resolutions, and operate passively or actively over the electromagnetic spectrum. Two EOS instruments, measuring Earth's radiation balance and lightning, were launched on the Tropical Rainfall Measuring Mission (TRMM) in November 1997. The first comprehensive EOS satellite (EOS AM-1) is scheduled for launch in 1998, with the primary focus on observing the Earth's surface, clouds, aerosols, and radiation balance. It will be followed by other satellites dedicated to other aspects of the Earth system so that there will be a minimum of 15 years of continuous Earth observation.

ERS-1 Synthetic A
(SAR) image of the
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EOSDIS

The EOS Data and Information System (EOSDIS) is designed to operate a suite of polar-orbiting satellites and instruments, capture the satellite data, generate useful Earth science data products, and make the products available to users in the U.S. and throughout the world. The two major parts of EOS-DIS are Mission System and Science System. The Mission System commands and controls EOS spacecraft and instruments, monitors their health and safety, and performs mission planning and scheduling, initial data capture, and initial data processing. Command of all of the EOS spacecraft and instruments occurs at the EOS Operations Center located at the Goddard Space Flight Center (GSFC) in Greenbelt, Maryland. The EOS instrument Principal Investigators (PIs) participate remotely from their home institutions in planning, scheduling, monitoring, and analyzing their instruments through EOSDIS-provided Instrument Support Toolkits. The Science System processes EOS data and archives and distributes all of ESE data to the user community. Especially for the Science System, EOSDIS has adopted a distributed information framework as the basic architecture of its design. Key components of this framework are the Distributed Active Archive Centers (DAACs), which have the institutional responsibility for holding the archive of ESE data products, and for making these products easily available to anyone who wants them.

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EOSDIS builds on existing scientific expertise at the DAACs and on existing DAAC responsibilities for archiving and distributing Earth science data. Each data center specializes in a particular Earth science discipline, providing comprehensive expertise for interdisciplinary studies. At present, EOSDIS manages a catalog of over 600 data sets, representing about 150 terabytes of data. The current system services about 50,000 distinct users and distributes about 2 terabytes of data to these users per month. Following the launch of EOS AM-1 in summer of 1998, EOSDIS will ramp up its product generation to accumulate about 1 terabyte per day and its distribution capacity to about 2 terabytes per day.

EOSDIS relies on an automated Information Management System (IMS) to help manage user discovery and distribution of its vast stores of data products. The IMS provides "one stop shopping" for Earth science data, allowing users to search for and order data in a single session from any or all of the EOS DAACs, and/or from several collaborating U.S. agencies and international partners. This free service allows easy access to both summary and detailed data descriptions, as well as browse images and fully processed science data products. The IMS provides interfaces to accommodate a variety of user computing environments ranging from desktop PCs to sophisticated graphical workstations. Access to data is currently available through the EOSDIS IMS, operating since August 1994. (Check the URL http://eos.nasa.gov/v0ims, or contact one of the EOSDIS data centers listed in this brochure.)

Evolution of EOSDIS

NASA recognizes that the only feasible approach to EOSDIS involves evolution and adaptation. NASA and EOSDIS users actively work together in the evolution of the EOSDIS to better respond to users' needs by taking advantage of new information system technologies as they emerge.

The next generation of EOSDIS is currently in development. It is designed to manage ESE satellite operations,
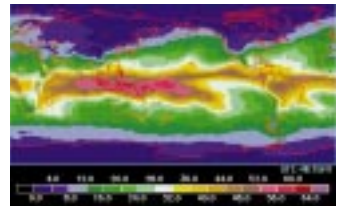
NASA Water Vapor Project (NVAP) global image of total integrated precipitable water for December 1992, derived from radiosonde observations, TIROS Operational Vertical Sounder (TOVS) and Special Sensor Microwave/Imager (SSM/I) data. High values (pink/red) dominate the western tropical Pacific Ocean and the eastern and central tropical Indian Ocean (NASA/Langely Research Center).
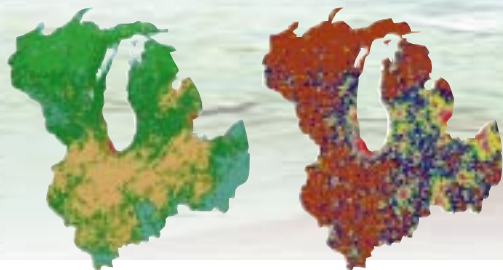
product generation, and data distribution in the Landsat-7 and EOS AM-1 era. It will provide a wide variety of choices for users wishing to make data, algorithms, and analysis tools available to the Earth science community. The information system that results from this open, extensible, and evolvable framework is intended to operate more as a marketplace and cooperative area than as a monolithic data production facility. Future generations of EOSDIS are also in the planning stage that extend the marketplace paradigm even further so that future participants in EOSDIS are no longer just users, but active contributors to a world-wide federation of Earth science data and information services. The next version of EOSDIS will be available in mid-1998.

A new approach to EOSDIS has recently been proposed by several review groups, including the National Research Council. The objective is to transfer responsibility for EOS product generation, publication, and user services to a "federation" of government, academic, and private partners selected through a competitive process. During 1998-2000, an experimental period, NASA plans to implement two federations; A Baseline Federation comprised of the current DAACs and other organizations responsible for EOS standard products, and a Working Prototype Federation formed by, but not limited to, a new set of "Working Prototype Earth Science Information Partners" (WP-ESIPs) selected by a competitive process.

TOPEX/Poseidon global images of wind speed, significant wave height, and water vapor content for the 10-day period 4-14 July 1997. Winds over 15 meters per second (red) and waves of 6 meters in height (also in red) are evident in the Southern Ocean. Consequently the lowest wind speeds and wave heights (purple) are found in the tropical and subtropical Oceans. High water vapor content (red) is evident in the western tropical Pacific Ocean and the eastern tropical Indian Ocean where the ocean surface waters are typically the warmest. Note the high water vapor content in the eastern equatorial Pacific which coincided with anomalously warm surface waters, indicating the onset of El Niño (Jet Propulsion Laboratory).

Distributed Active Archive Centers
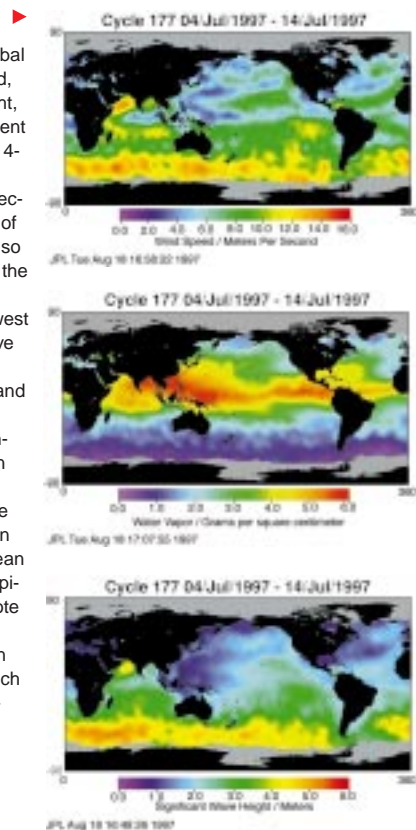
The data managed by EOSDIS are available from eight EOSDIS Distributed Active Archive Centers (DAACs), two affiliated data centers, and a growing number of international partners. These data centers process, archive, and/or distribute EOS and other NASA Earth science data, and provide full support to users of these data. Each data center holds and provides data pertaining to a particular Earth science discipline, and they collectively provide a physically distributed but logically integrated database to support interdisciplinary research into global climate change. Data centers provide services tailored to the specific needs of their individual discipline user communities, and together they provide coordinated services to support interdisciplinary Earth science research.

DISTRIBUTED ACTIVE ARCHIVE CENTERS:

Alaska SAR Facility (ASF)
Sea Ice, Polar Process Imagery (SAR)
University of Alaska
P.O. Box 75720
Fairbanks, AK 99775-7320
Voice: (907) 474-6166 • Fax: (907) 474-5195
Email: asf@eos.nasa.gov
URL: http://www.asf.alaska.edu

The Consortium for International Earth Science Information Network - Socioeconomic Data and Applications Center (CIESIN-SEDAC)
Human Interactions in the Environment
CIESIN
2250 Pierce Road
University Center, MI 48710
Voice: (517) 797-2700 • Fax: (517) 797-2622
Email: ciesin.info@ciesin.org
URLs: http://sedac.ciesin.org
http://www.ciesin.org

EROS Data Center (EDC)
Land Processes Imagery
U.S. Geological Survey
Sioux Falls, SD 57198
Voice: (605) 594-6116 • Fax: (605) 594-6963
Email: edc@eos.nasa.gov
URL: http://edcwww.cr.usgs.gov/landdaac

NASA/Goddard Space Flight Center (GSFC)
Upper Atmosphere, Atmosphere Dynamics, Global Biosphere, Geophysics
NASA/Goddard Space Flight Center
Code 902.2
Greenbelt, MD 20771
Voice: (301) 614-5224 • Fax: (301) 614-5268
Email: gsfc@eos.nasa.gov
URL: http://daac.gsfc.nasa.gov

Jet Propulsion Laboratory (JPL)
Physical Oceanography
Jet Propulsion Laboratory
MS 300-320
4800 Oak Grove Drive
Pasadena, CA 91109
Voice: (818) 354-9890 • Fax: (818) 393-2718
Email: jpl@eos.nasa.gov
URL: http://podaac.jpl.nasa.gov

NASA/Langley Research Center (LARC)
Radiation Budget, Aerosols, Tropospheric Chemistry, Clouds
NASA/Langley Research Center
MS 157D
Hampton, VA 23681-0001
Voice: (757) 864-8660 • Fax: (757) 864-8807
Email: larc@eos.nasa.gov
URL: http://eosweb.larc.nasa.gov/

National Snow and Ice Data Center (NSIDC)
Snow and Ice, Cryosphere and Climate
CIRES, Campus Box 449
University of Colorado
Boulder, CO 80309-0449
Voice: (303) 492-6199 • Fax: (303) 492-2468
Email: nsidc@eos.nasa.gov
URL: http://www-nsidc.colorado.edu/nasa

Oak Ridge National Laboratory (ORNL)
Biogeochemical Dynamics
Oak Ridge National Laboratory
P.O. Box 2008, MS 6407
Oak Ridge, TN 37831-6490
Voice: (423) 241-3952 • Fax: (423) 574-4665
Email: ornl@eos.nasa.gov
URL: http://www-eosdis.ornl.gov/

AFFILIATED DATA CENTERS:

**National Oceanic and Atmospheric Administration
Satellite Active Archive (NOAA-SAA)**
Satellite Data – Atmosphere, Land, Ocean, Earth sciences,
Remote Sensing
NOAA-SAA National Climatic Data Center
151 Patton Avenue
Asheville, NC 28801-5001
Voice: (704) 271-4800 • Fax: (704) 271-4876
Email: saainfo@nesdis.noaa.gov
URL: http://www.saa.noaa.gov

Global Hydrology Research Center (GHRC)
977 Explorer Boulevard
Huntsville, AL 35806
Voice: (205) 922-5932 • Fax: (205) 922-5859
Email: ghrc@eos.nasa.gov
URL: http://ghrc.msfc.nasa.gov
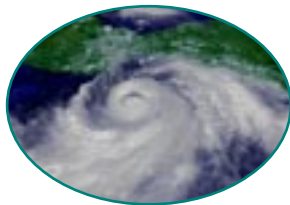
GLOBAL CHANGE MASTER DIRECTORY

Comprehensive source of information about Earth science data
sets and data centers.
American Coordinating Node of the Committee on Earth
Observation Satellites International Directory Network
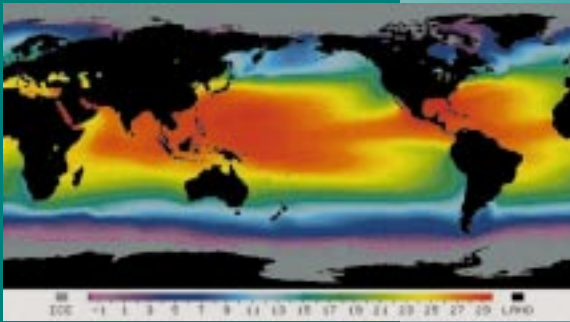(CEOS IDN).
NASA/Goodard Space Flight Center
Code 902
Greenbelt, MD 20771
Voice: (301) 441-4202 • Fax: (301) 441-9486
Email: gcmduso@gcmd.gsfc.nasa.gov
URL: http://gcmd.gsfc.nasa.gov

*Access to data and services from all of
these archive centers is available at
http://eos.nasa.gov/v0ims*

◀ **Advanced Very High Resolution Radiometer (AVHRR) Oceans Pathfinder global averaged Sea Surface Temperature distribution showing extensive areas of warmer tropical and subtropical waters in the western Pacific and Indian oceans (Jet Propulsion Laboratory).**

Normalized Difference Vegetation Index (NDVI) for the U.S., Canada, Mexico, Caribbean, and northern South America for 21-31 August 1997, derived from the Advanced Very High Resolution Radiometer (AVHRR) on board NOAA-14. NDVI is produced from visible and near-infrared reflectances and is effective in differentiating vegetation and soil. Vegetation (green) is plentiful with embedded high values (red) indicating greater density and greenness of the plant canopy, while low values (brown and white) typify the rock and rock and bare soil of the Rockies and northern Canada (Goddard Space Flight Center). ▶
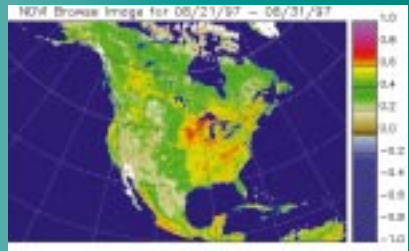
◀ **NASA Landsat Pathfinder North American Landscape Characterization Project high-resolution image of Denali National Park, in central Alaska just north of Mt. McKinley (EROS Data Center).**

▲ **Boreal Ecosystem-Atmosphere Study (BOREAS) 1994, false color mid-infrared image over south-central Canada produced from the Airborne Visible and Infrared Imaging Spectrometer (AVIRIS) (Oak Ridge National Laboratory).**
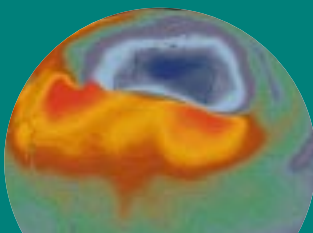
◀ **Antarctic ozone "hole" measured in Dobson units by the Nimbus-7 Total Ozone Mapping Spectrometer (TOMS). Thinning of total column ozone density is shown in blue. (Laboratory for Atmospheres, Goddard Space Flight Center).**

EARTH OBSERVING SYSTEM DATA AND INFORMATION SYSTEM

EOSDIS

NASA